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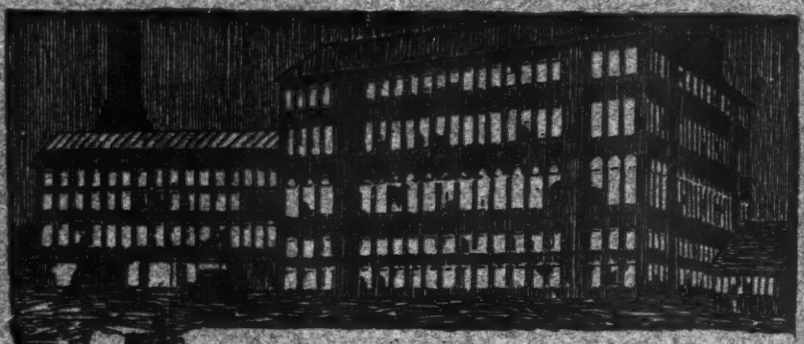
This number contains the paper read by Mr. L. GASTER on **"The Lighting of Printing Works"** before **The Illuminating Engineering Society** on April 24th, and the ensuing discussion.

Other matters dealt with include :—

STANDARDS OF INDUSTRIAL LIGHTING. A NEW ILLUMINATION PHOTOMETER. REVIEWS OF BOOKS. TRADE NOTES, ETC.



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EDITORIAL.

The Lighting of Printing Works.

There is perhaps no industry in which the value of good lighting is better illustrated than in *printing*, involving at once neatness, accuracy and speed of execution. The same qualities are required in editorial work, often carried out at high pressure. Further, the industry is a large and important one, paying a sum in wages which must amount, in the aggregate, to some millions of pounds per annum.

This is also an excellent instance of the need for consulting the *user* of light. In order to make recommendations on the lighting of a printing works one must understand something of the complex processes carried out, the work of composition which in some respects has been materially modified by recent developments, and such machinery as the large rotary presses used in modern newspaper works. It was therefore gratifying to hear the views of the various representatives of the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom, and especially to observe the general opinion that both employers and works in the printing trade are keenly alive to the benefits of good illumination. Sir Malcolm Delevingne, in opening the discussion of the recent paper on " Industrial Lighting and the Prevention of Accidents " read by the writer before the Royal Society of Arts, paid a tribute to the sympathetic co-operation of Joint Industrial Councils with the Home Office in studying factory lighting. There is no doubt that they afford a most valuable channel for obtaining

information on the lighting requirements of different industries and the best methods of meeting them in practice.

It may be recalled that the lighting of printing works formed the subject of two valuable papers by Mr. J. Eck and Mr. F. W. Goodenough in 1912, and the writer's paper was intended as a supplementary review of recent developments. The introduction of gasfilled electric lamps and similar advances in the efficiency of incandescent gas burners has given an impetus to overhead systems of lighting and it appeared from the discussion that this method, which gives a clear view of the room, is in general preferred to the old method of only allotting lamps to individual frames in compositors' rooms. Another point, mentioned by Mr. Paul Walmsley, is that nowadays the compositor is rarely occupied continuously at one spot, but has frequently to move about in search of material. Hence it is advantageous to have the room as a whole well lighted. On one point all speakers were agreed, the need for eliminating the dazzling effect on the eyes of the compositor of unscreened lamps within the direct range of vision. The work of compositors is exacting and requires a relatively high illumination, and it is to be noted that in some of the installations visited values as high as 8-12 foot-candles were provided. In this and other cases a distinction should be drawn between values mentioned as an indication of the best modern practice and *minimum* values proposed by the Home Office, which must naturally be on a more conservative basis.

However, the intensity of illumination is only one of the factors to be considered. In most printing operations the direction from which the light comes is at least equally important. This is particularly noticeable in machine rooms which contain bulky and complex rotary presses, etc. It is scarcely possible to illuminate the interior mechanism effectively by any existing system of general illumination, and operators require the aid of special local lamps. In this case, as in the case of textile machinery, the best solution would be found if designers of machinery would study the lighting conditions required, and provide for suitable and easily accessible outlets for lamps as an integral part of the machine. For proof-reading, and for the lighting of manuscripts and adjusting apparatus such as monotype and linotype machines, special local lamps are usually provided. The intensity of illumination required in both cases is high, and the shielding and location of the source, so as to provide an even illumination free from glare, needs study. It was interesting to hear from Mr. Riddell that all these matters have received close attention at the London School of Printing, where the lighting arrangements are stated to be exceptionally complete.

Colour-printing, which has made such strides during recent years, presents a special field, which could only be briefly mentioned in a general paper. There should be good opportunities for "artificial daylight" here if units which are both sufficiently close to daylight and provide the requisite high illumination can be furnished. In this connection it was interesting to hear particulars of the form of glass exhibited by Mr. F. E. Lamplough, which is stated to be a distinct advance on the varieties shown by him at previous meetings of the Society.

The provision of good lighting, both in printing and editorial departments, thus offers a very fruitful field for study. Several speakers referred to the differences in opinion expressed by managers and workers on various problems, and an authoritative ruling on some of these points would be helpful. It is proposed to deal with these matters by means of a small joint committee, on which representatives of the Joint Industrial Council of the Printing and Allied Trades and lighting experts will co-operate.

Lighting Requirements, Recommendations and Standards.

The discussion of the writer's recent paper on industrial lighting before the Royal Society of Arts, on May 16th, dealt very largely with the problem of making recommendations and prescribing standards of illumination for industrial lighting. Sir Malcolm Delevingne (Assistant Under-Secretary of State, Home Office), who presided, gave a welcome assurance that provisions requiring adequate lighting would be included in the next Factory Act, and the discussion revealed a general recognition of the importance of adequate lighting in factories. There were, in fact, some who favoured the framing of somewhat detailed rules and standards for the guidance of manufacturers. We have always actively encouraged efforts to improve the status of lighting in schools, factories and other classes of buildings, and recommendations have been made by various joint committees of the Illuminating Engineering Society on these matters. But it is necessary to draw a very clear distinction between a *recommendation* tentatively suggested as an indication of good modern practice, and *minimum standards* which imply a definite decision and may be given legal status.

In making recommendations one must naturally be sure of one's ground, and be able to supply convincing evidence that they are justified. In dealing with industrial lighting, for instance, one may recommend values of illumination for certain purposes, but success in inducing manufacturers to accept them will be based very largely on the data one can submit to show that their adoption will ensure greater output than is possible with a lower order of illumination, less spoiled work, greater freedom from accidents, etc. Concrete instances of improved results in these directions, as a result of better lighting, are extremely valuable, and we shall welcome information of this kind.

When one comes to legal standards, involving penalties for non-compliance, even greater care is needed. We have to be sure, firstly, that such requirements are necessary, secondly, that they can be met without undue hardship. And we must also be able to show that failure to comply with them will cause injury either by impairing health or prejudicing safety. Hence standards of this kind are necessarily *minima*, such as would often be exceeded by progressive manufacturers in their own interests. The Home Office Committee was on sure ground in prescribing minima, easily complied with in practice, and clearly desirable in the interests of safety and convenience. But it decided that the question of the illumination desirable for the efficient performance of work, which naturally depends so much on the nature of the process illuminated, required further study by experts working in co-operation with representatives of the industries concerned.

This standpoint should be thoroughly appreciated by firms in the lighting industry. They should recognise that minima endorsed by authorities are of great utility to them, as well as being in the public interest. And their own recommendations of what is desirable in practice should be framed with due regard to these and other data that are backed by impartial authority, and wide experience.

Illuminating Engineering Propaganda.

While the Illuminating Engineering Society is recognised to have played a leading part in the movement to bring about better lighting conditions in this country we have always recognised that there was room for the efforts of others, working in co-operation. Companies concerned with the supply of gas or electricity, or manufacturers of lamps and lighting appliances can do—and in many cases have done—a great deal towards spreading the principles with which the Society is identified. The demonstration of the British Thomson-Houston Co., Ltd., at their premises in Savoy Street, on July 19th, was in many respects a praiseworthy effort. A considerable number of members of the Society were present and witnessed with pleasure the practical demonstrations of the use of illumination photometers, the ingenious experiments illustrating effects of glare, shadows and colour, and good and bad methods in lighting show-windows, etc., which accompanied the address by Mr. W. E. Bush.

Progressive concerns now recognise that their activities should not be confined to the selling of goods, but should include " service "—the furnishing of advice on the best methods of using the lamps and lighting appliances supplied. There is doubtless a field for such demonstrations which, if wisely conducted, form a useful supplement to the work of the Society. Firms concerned with lamps and accessories have often excellent facilities for demonstrations, and in illuminating engineering experiments that appeal to the eye are often very successful, and form a useful supplement to information conveyed by printed literature or verbal descriptions.

There are, however, a few principles which should be observed in such demonstrations, and which the writer referred to in proposing a vote of thanks to the Company for their demonstration. We hope that in such cases every use will be made of data presented at meetings of the Illuminating Engineering Societies in this and other countries, and every opportunity taken of endorsing the principles advocated by them, or by other acknowledged authorities. When, in this country, a recommendation is made to the consumer, the first questions he asks are usually, " What is your authority ? What evidence can you quote in support of your assertions ? What data can you present to satisfy me that I shall really benefit from your advice ? " It is naturally an advantage to be able to refer to the conclusions of a body which represents not only all systems of lighting, but also both the maker of lighting appliances and the *user* of light. Such data as those afforded in the reports of the Home Office Departmental Committee are extremely valuable, and have been quoted by most progressive firms with good effect.

The second point, that really arises from the first, is the desirability of unity of effort on the part of firms in approaching the public, or furnishing information for the guidance of contractors—a body of men who can also do a great deal of useful educational work. Electrical contractors appreciate helpful information on developments in lighting. But if they and the public receive conflicting recommendations from various firms, or suggestions that are not in accord with conclusions of the Illuminating Engineering Society, or are otherwise opposed to unchallengeable authority, the only result will be to cause confusion and destroy confidence. If, on the other hand, firms will continue to work in co-operation with the Illuminating Engineering Society, and ensure unity of aims by frequent conference, their efforts will be beneficial not only to themselves but to the illuminating engineering movement as a whole.

LEON GASTER.

TRANSACTIONS

OF

The Illuminating Engineering Society.

(Founded in London, 1909.)

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

THE LIGHTING OF PRINTING WORKS.

(Proceedings at the meeting of the Illuminating Engineering Society held at the House of the Royal Society of Arts, 18, John Street, Adelphi, W.C., at 8 p.m., on Tuesday, April 24th, 1923.)

A MEETING of the Society was held at the House of the Royal Society of Arts, 18, John Street, Adelphi, W.C., at 8 p.m. on Tuesday, April 24th, the Chair being taken by Mr. F. W. BRIDGES.

The minutes of the last meeting having been taken as read, the HON. SECRETARY presented the name of the following applicant for membership :—

Mr. F. WALKER .. .. Lighting Expert, Boots The Chemists, Station Street, Nottingham.

The names of applicants read out at the last meeting on March 27th* were read out again, and these gentlemen were formally declared members of the Society.

THE CHAIRMAN, in opening the proceedings, remarked that this was a subject on which the co-operation of those engaged in journalism and printing was needed. The Society had accordingly invited the attendance of representatives of the Institute of Journalists, the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom, and other bodies interested.

The Chairman then called upon Mr. L. GASTER to read his paper on **"The Lighting of Printing Works."** In the ensuing discussion the Right Hon. C. W. BOWERMAN, M.P. (Past-President of the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom), Mr. A. E. GOODWIN and Mr. A. E. HOLMES (Joint Secretaries of this Council), Mrs. BRIDGE (Chairman of the Health Committee of the Council), Mr. E. PONTIS, Mr. GEO. ISAACS (Secretary of the National Society of Operative Printers), Mr. J. R. RIDDELL (Principal of the London School of Printing), Mr. GEO. W. MASCARD (United Newspapers, Ltd.), Mr. J. G. CLARK, Mr. G. CAMPBELL, Mr. P. J. WALDRAM, and Mr. F. E. LAMPLOUGH took part. Mr. L. GASTER having briefly replied to the discussion, a vote of thanks to the lecturer and the Chairman terminated the proceedings, after which it was announced that the next meeting would be held on May 24th, when Dr. J. F. CROWLEY would read a paper on the **Use of Synchronously Intermittent Light in Industry** and Mr. P. ORD would give a demonstration of apparatus for the **Comparison of Natural and Artificial Daylight.**

* ILLUM. ENG., April-May, 1923, p. 89.

SOME PROBLEMS IN THE LIGHTING OF PRINTING WORKS.

(Compositors' Frames, Machine Rooms, Editorial and Proof-Reading Departments, etc.)

BY L. GASTER, F.J.I.

[Summary of Paper (illustrated by lantern slides) presented at the meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 8 p.m., on Tuesday, April 24th, 1923.]

THE subject of the lighting of printing works has already been dealt with in two able papers presented by Mr. F. W. Goodenough and Mr. Justus Eck in 1912.*

This discussion afforded much valuable information on conditions in good installations, and many of the suggestions in regard to lighting apply equally well to-day. But there have since been some notable developments in illuminants that may modify pre-war practice,—such as the introduction of the gasfilled lamp, the development of "artificial daylight" and the use of vitreosil globes and cylinders in gas lighting.

On this occasion we hope to hear the views of two bodies closely concerned with lighting conditions in printing and newspaper offices, (A) the journalists who prepare material for publication, and (B) the printers whose skill makes this information available to the public.

I may take as a starting point a sentence in Mr. Goodenough's paper in 1912: "I doubt if there exists any industry in which good lighting has more effect on the successful running of the concern than is the case in the printing trade." Consider conditions in a printing works and the complicated organisation responsible for the publication of a newspaper. The keen competition in the printing industry is based on service as well as price, and the printer who can render superior service can command a better price. Service in printing involves chiefly accurate, neat and quick work, each of which requires good illumination. Delay in any of the various stages of composition, make-up, presswork and binding may make all the difference between profit and loss. Excessive revisions of proofs represent not only lost time, but needless cost, and in many cases this may be charged to poor lighting. On the editorial side we have likewise a need for meticulous accuracy combined with rapidity of execution. Finally we should bear in mind that the product of both journalists and printers is prepared exclusively for exhibition to *the eye*. This fact alone makes it essential that the work of preparation should be done under good lighting conditions, enabling the material to be inspected with ease and comfort.

In discussions before the Illuminating Engineering Society it has been repeatedly pointed out that the cost of good lighting forms but a small fraction of the total costs of production. In printing offices this is particularly true, for highly skilled labour is employed, costly machinery is used, and overall charges are commonly high. If we estimate that the cost of artificial lighting amounts to 1s. a man per week, and that the wages he receives are about £4—£5 a week, it is seen that cost of lighting forms about 1 per cent. of the wages bill. This is confirmed by the author's experience in cases where the wages bill varied from £20,000 to £500,000 per annum, and the expenditure on lighting from £200 to £5,000. In many cases less would be paid and the fraction would be even smaller. An idea of the loss that may arise by inadequate lighting is afforded in a contribution by Mr. F. H. Bernhard to the *Electrical Review* (U.S.A.). In a large printing works it was found that after the conditions of illumination had been thoroughly modernised the general efficiency of work was improved by 25 per cent.*

* ILLUM. ENG., April, 1912, pp. 171–201.

* *Elec. Review*, U.S.A., Aug. 24th, 1918.

To a modern newspaper the consequences of a bad mistake in the setting of type, or an accident to machinery that delays production, may be serious. The reputation of a newspaper is bound up with regularity of routine, which is very liable to be interrupted if the lighting is inadequate, imposing a strain on workers and rendering it difficult to keep machinery in perfect and efficient condition.

From the operator's side the importance of good lighting should also be emphasised. Printers as a whole, and compositors especially are probably above the average of workmen intellectually, working as they do continually with the eye and the brain as well as the hands. They are, therefore, more sensitive to working conditions and appreciative of their improvement. I understand that defects of eyesight are exceptionally frequent among compositors, which may be ascribed partly to work under inadequate lighting. Improved lighting means not only greater visual comfort, but a more cheerful workroom. Journalism may likewise be regarded as an exacting intellectual occupation.

Consider, too, the large number of operators engaged in the printing industry, which is estimated to be about 250,000 in the United Kingdom. There are probably about 15,000 compositors in London alone, and about 30,000 in the provinces. If we add those engaged in journalistic work, amounting to tens of thousands, it will be seen that the aggregate sum paid in wages must run into many millions per annum. If by better lighting, one can secure even a small improvement in quality of work and speed of execution, owing to the avoidance of unnecessary delays and mistakes, a large saving might be made on this sum.

The installations described in the former discussion before the Society were in the main typical of good modern methods. But one still finds newspaper offices in which antiquated methods are employed. Unshaded lamps are too frequent, and the simple conical cardboard shades used throughout some works must now be regarded as obsolete. In most sections of a works the aim should be to provide general illumination by lighting units of high candlepower, placed high up so as to be out of the range of view. A series of drop-lights terminating in lamps of small candlepower is inefficient, unsightly and inconvenient. Nevertheless, the general lighting sometimes requires to be supplemented by a few local units, as many printing processes require lighting of this nature. In one respect the printing industry has an advantage over some other trades. Each machine has its allotted task and is invariably used for the same purpose. It is worth while, therefore, to scheme out suitable lighting, recognising that it should not require continual adjustment—as may happen in factories where the nature of the work and the duties required from machines change from time to time.

Although the procedure has recently been modified by the introduction of automatic type-setting machinery, the lighting of compositors' frames still forms an important problem. The writer has observed three main methods of lighting: (1) unshaded or imperfectly shaded lamps placed over the centre line so as to illuminate the racks on either side; (2) lamps equipped with suitable reflectors used in the same way; and (3) general lighting from overhead lamps, *e.g.*, semi-indirect lighting with sources situated between benches so that the light comes over the worker's shoulders. The first method cannot be recommended. The exposed filaments are troublesome to the eyes of the workers and the proportion of light reaching the racks is very low. But if the lamps are equipped with suitable reflectors and their distance above the top-line of the frame is suitably selected, it is possible by method (2) to obtain very good illumination on the actual inclined face of the frame. Some compositors still prefer local lighting of this description. It is, however, usually desirable to supplement this mode of lighting by general illumination from overhead sources—(*a*) in order to throw light on the drawers below the inclined face, which would otherwise be insufficiently illuminated; (*b*) to ensure adequate lighting of gangways between benches; and (*c*) to eliminate an undue contrast between the illuminated rack and the surroundings.

The alternative method of depending on overhead light is much more feasible with modern illuminants than with the low candlepower lamps of the past. It has the merit that the light comes from above and behind the worker and there is less likelihood of inconvenient reflection from the surface of the bench. In addition, the drawers receive a better illumination. Thus in a recent installation of this kind it was found that the illumination on the frame was 6—8 foot-candles, and even drawers quite low down still received one foot-candle.

The question whether individual local shaded lights or good overhead general illumination is better for compositors' frames is one on which the views of the compositors themselves, and the reasons why they prefer certain arrangements to others, would be welcome. In the discussion before the Society in 1912 values in general ranging from 5—10 foot-candles (average) were recorded. In view of the fact that considerable variations in illumination at different points on a bench are often in evidence, it would seem that the average illumination, whether provided by general or local lighting, should lie within these limits. In good modern installations 5 foot-candles is doubtless usual. But there are still many works where much lower values would be recorded.

The lighting of linotype or monotype matrix boxes, where manuscripts are "tapped out," is usually effected by adjustable local lights placed about 18 inches above the keys and screened on the side facing the worker. This is a process that needs strong local lighting, as the operator has not only to see the keys, but to distinguish the more or less illegible handwriting of the contributions he is dealing with. Such sources need very careful shading. Average values recorded by Mr. Eck for linotype machines were up to 25 foot-candles on the matrix box, 4·3 on the keyboard and 4 on the copy. A recent test in a printing works by the author gave 4—8 foot-candles on the keyboard, 4—8 on the "copy" and 4 on the setting drum (measured vertically)—the latter being a particularly important spot in view of the small letters and numbers on the drum that have to be distinguished.

It would appear that the illumination of the manuscript, at any rate, should not be less than 4—5 foot-candles, in view of the small type or imperfect handwriting that the operator frequently has to decipher.

In *machine rooms* it is obviously desirable that the surroundings should be light in colour and the illumination very fully diffused so that all interstices in complicated machinery are clearly revealed. I would suggest that, in the interests of safety, the illumination at floor-level should not be less than 0·5 foot-candles, irrespective of the illumination provided for the actual work. On laying-on and taking-off tables, where sheets are placed and inspected, a value of about 5 foot-candles is desirable, and this value is exceeded in some well-lighted works recently visited. The point may be raised whether, for the examination of first sheets, general diffused lighting is sufficient. The printer, in judging the impressions of type and blocks, is guided very largely by small indentations in the paper, and it is possible that these would be revealed more fully by oblique unidirectional lighting. It might, therefore, be good practice to supplement the general lighting by a local adjustable fitting, the position of which with regard to the paper could be altered according to the needs of the operator.

In this department the importance of good lighting can hardly be over-estimated. Any fault in the running of machinery is much more difficult to detect and remedy if the lighting is insufficient. The author has met cases in which constant breakdowns and vexatious delays were occurring in a badly-lighted room, but practically ceased when modern and adequate illumination was installed.

The proper illumination of the machinery, especially the huge rotary presses of the present day, is something of a problem. The conditions resemble somewhat those met with in textile factories. One may do everything possible by the placing and shading of the permanent general lights, and by the use of light surroundings, to promote good diffusion of light. But it is hardly possible by the aid of general illumination

alone to ensure that all the requisite parts of such complex machinery will be well illuminated and clearly seen. This is a question that might well receive some attention from designers of such machinery, who should bear in mind the desirability of important parts being easily accessible and readily inspected. They might go further and embody in the design of the machine suitable facilities for the permanent mounting of supplementary protected lamps illuminating the vital parts where adjustments are made. In the absence of such facilities the attendant must rely on the use of portable lamps or special pendant lights at essential points. As a matter of principle no unprotected lamp should be inserted within the machine, as the trouble arising in the event of a lamp being broken would be considerable. The lamps must be so situated or used that a flood of light can be directed on the part inspected without the operator's eyes being dazzled by glare from an exposed mantle or filament, or inconvenient shadows being cast by his body.

In rooms for packing and despatching the conditions of illumination are simple, and in lofty rooms semi-indirect lighting affording 2—3 foot-candles should answer requirements.

At this stage it may be useful to give some indication of the order of illumination for various processes, as measured on the actual place of work. In the following table are assembled in the first column a set of values based roughly on the readings given in the papers by Messrs. Eck and Goodenough in 1912; in the second column a few figures just obtained by the writer in a well-lighted modern printing works, and in the third and fourth columns the values recommended respectively by the Home Office Departmental Committee on Lighting in Factories and Workshops (Third Report) and in the Code of the American Illuminating Engineering Society. The figures are interesting as showing the great variations met with in different works for identical processes, and also as an indication that the values indicated in the Home Office Report are such as can readily be complied with in practice.

Process.	Illumination (Foot-candles).			
	Limits of values given by Mr. Eck and Mr. Goodenough.	Author's tests in 1923.	Home Office Third Report. Recommended *Minima*.	Code of American Illuminating Engineering Society. (*Approved Practice.*)
Linotype and Monotype Machines { On Copy .. / On Keyboard .. }	4—25 / 3—8	3—8	5	10—20
Type-setting in Composing Rooms :—				
On Frames .. .. / On Imposition Benches	5—14 / 2—10	6—8	5	10—20
Stereo Foundry	0·5—4	—	3	5—10
Machine Room :—				
On Printing Presses and Examiners' Tables	1—8	4—8	3	5—10
Editorial Rooms	3—15	—	3	5—10
Proof-reading	3—10	5—10	3	5—10
Packing, Folding, Despatching, etc. ..	2·5—6	—	3	2—5

The values of illumination mentioned throughout the paper are not in any sense final recommendations but are merely used to illustrate conditions met with in typical modern installations. While practice in different works varies, it should be possible, by means of tests conducted in co-operation with those employed in the industry, to determine

desirable minima based on scientific investigation. But it must, of course, be recognised that the mere provision of suitable numerical values of illumination *alone* is not sufficient to ensure adequate lighting and that attention must be paid to such important factors as absence of glare, avoidance of inconvenient shadows, etc.

The making of process blocks, lithographic work, engraving, etc., is a special subject in itself and the need for good illumination here is particularly vital. Engraving processes are frequently mentioned as an instance of "fine work" requiring specially high illumination, and as the operator is here concerned with small projections and indentations of the surface, local adjustable lights seem desirable in addition to moderate general lighting. In etching and lithography the conditions are different and operators seem to prefer a very highly diffused source, with an extensive luminous area, which is reflected in the more or less polished material in which they are working. A typical device, in which the lamp is shielded between two inclined sheets of translucent paper, used in the School of Arts and Crafts, has been described in the book by the writer and Mr. Dow.

Colour-printing again is a process requiring highly-specialised illumination, as one needs not only an exceptionally high illumination, but a quality of light enabling colours to be revealed in the same manner as by daylight. For the mixing of inks and pigments light with a spectrum very closely resembling that of daylight is essential. A few years ago it would have been very difficult to meet this requirement by any form of artificial light, though special arc lamps appeared to have answered in some cases in view of the small departure in the colour of the light from daylight. Mr. J. Eck, in his paper before the Society in 1912, mentioned a case in which a combination of an inverted gas mantle and a tungsten lamp was used to obtain an approach to daylight. But, as a rule, colours could not be matched, either for tint or depth of colour, by artificial light, and work uncompleted by dusk had to be left over until the next day.

The developments in "artificial daylight," which have been the subject of several recent contributions to the proceedings of this Society, are of very great interest to colour printers, and in many cases the system has been used with benefit and has enabled work to be carried on successfully when daylight failed. In installing such systems it should be recognised that the loss of light through absorption and consequent greater expenditure of energy to obtain the requisite illumination is of little moment, provided the advantage of being able to work consistently by artificial light is obtained. It is expensive to attempt to light the entire room by this means. The aim should be to concentrate the light at the place of inspection, which should be screened from the general uncorrected artificial illumination, and to obtain an illumination which approaches normal daylight not merely in colour but also in intensity. The question of the accurate comparison of "artificial daylight" systems with natural light, with a view to determining their accuracy for various purposes, is exceedingly important and members may be interested to know that a contribution on this subject is to be presented at the annual meeting in May by Mr. Ord (of Adam Hilger, Ltd.).

I come now to an important section of the work of producing a newspaper, namely, the *editorial*, *proof-reading* and other departments concerned with the examination of "copy." It is singular that in some newspaper offices where the need of good lighting in the printing section has been fully recognised, the editorial department conducts its work in very meagre and inadequate light. The requirements for ordinary reading and writing were studied by the joint committees of the Society concerned with the lighting of schools and libraries prior to the war, and office lighting has recently been the subject of discussion. The general conclusions formed in regard to these fields of lighting apply to newspaper offices, but the requirements are even more exacting. A child at school or a reader in a library is assumed to deal with clean white paper and well-printed books. But the matter sent in to a newspaper is still largely written by hand, often in hurried and crabbed

writing and on flimsy paper that makes it still more difficult to distinguish. Even matter presented in proof often does not compare favourably with the appearance of the type in the finished production. Its examination is often conducted at high pressure, as the printers are waiting for the return of copy; yet extreme accuracy both in the editorial and proof-reading departments is vital to the reputation of the paper.

Journalists, therefore, are entitled to illumination just as suitable for their needs as that provided in the printing section. In many editorial offices the lighting is done in a very improvised and unsatisfactory manner. Lamps are used without shades and are allowed to become extremely dirty. In some cases the outlets are wrongly placed in regard to the furniture and drop-lights have to be "fetched across" by means of cords. An editor's or sub-editor's room should contain suitable general lighting preferably of the semi-indirect type, supplemented by a well-shaded table lamp. Proof-readers also in general would prefer a special lamp over their work. In view of the arduous nature of the work, 5 foot-candles on the desk, which can easily be provided by the aid of modern lighting appliances, should be the minimum. The lower portions of lamps should be frosted with a view to preventing troublesome striations and inequalities in the illumination, a common defect when local lamps are used.

In the discussion before the Society on "Office Lighting" attention was drawn to the drawback of writing consignment notes, receipts, etc., in indelible ink on coloured or shiny paper. When the writing has a shiny surface the words may become quite troublesome to decipher, and it is common to see a person examining such documents turning them from one side to the other so as to try and get the light at an angle that eliminates these annoying reflections. The same applies generally to reporter's copy written on thin paper in pencil, which must add to his own difficulties besides that of the editorial staff who have to deal with his transcript. In passing, I would also like to put in a word regarding the lighting of galleries or tables used by reporters in reporting public meetings, etc. Although the process of putting things down in shorthand may be largely automatic, a reasonable illumination of say 3–4 foot-candles should be available at the surfaces where writing is done.

In conclusion, it may be useful to add a summary of the chief points in the paper, which will serve as a basis for discussion :—

(1) Printing is a highly specialised and complex process involving the use of costly and elaborate machinery. Good lighting is, therefore, of vital importance, and its cost forms only a small fraction of the total operating expenses.

(2) In rooms containing quick-running rotary presses, etc., there should be general illumination from overhead lights, equipped with suitable bowls or reflectors, well out of the normal range of vision of workers. No exposed bright lights liable to distract the attention of workers should be permitted. Facilities for the illumination of parts of machinery without glare in the eyes of the operator should be provided, either by use of shaded portable lamps or screened sources mounted as a permanent element in the design. General illumination on the floor should, in the interests of safety, not be less than 0·5 foot-candles, irrespective of the "working illumination" provided to enable processes to be expeditiously carried out.

(3) The illumination on compositors' frames, making-up tables, lay-out surfaces and other places where work is inspected should not be less than 5 foot-candles and should preferably exceed this value. The same applies to keyboards of matrix machines, which require local lighting. All local lights should be completely screened from the eyes of the worker.

(4) In editorial and proof-reading rooms the working illumination should not be less than 5 foot-candles, preferably afforded by a well-shaded local lamp, supplementary to general illumination, in order to avoid undue contrast in the brightness of desk-surfaces with the surroundings.

The paper was illustrated by lantern slides and the results of tests of illumination in various printing works, and

the merits of the alternative methods of lighting suggested in various sections of the paper should afford ground for useful discussion. The co-operation of those engaged in the printing trade is sought in discussing these problems, and the Society would doubtless be willing to follow the precedent established at other discussions of forming a small joint committee to consider these problems in greater detail.

In conclusion I wish to express my indebtedness to the courtesy of the various firms who have kindly furnished information on methods of lighting, and in particular to the assistance I have derived from Mr. J. S. Dow in the preparation of this paper.

DISCUSSION.

The CHAIRMAN (Mr. F. W. BRIDGES) said that, before opening the discussion, might he be allowed to say how gratified he was to be accorded the privilege of occupying the Chair on such an important occasion. There might be others in the room who could occupy the position a great deal better than he, but he felt that he was perfectly justified in saying that there was no one in the room more keenly interested in the subject which they had to discuss. As one who had taken a great interest in the subject for more years than he cared to say, he felt that this was a subject to which too much importance could not be attached; the question of efficient lighting anywhere was an important one, but more particularly so in connection with a business like printing, where the eyesight played such an important part. He thought that all present would agree that the question of lighting was really as important as any subject of hygiene or anything kindred to that. There had been a health committee appointed in connection with the Joint Industrial Council of the Printing Trade, and that Committee had had various subjects to discuss; among others the question of lighting had engaged a certain amount of their attention. Owing to the peculiar position which he occupied, he was and always had been regarded as a sort of buffer between employers and workers in the printing trade, and this being a matter which affected both employers and workers, he felt that he was not altogether out of place in occupying the Chair. He was there as a learner. He believed that they would have a very important paper, and, what was better still, a very important discussion, and, as the result of the meeting, he was looking forward to very great things being accomplished in the printing trade. (Applause.)

The Right Hon. C. W. BOWERMAN, M.P., said that the discussion showed how much attention had been devoted to artificial lighting during recent years. He wondered what would have been said by the old compositor of not so many years ago if he had sat in the room and listened to the lecture. There was a time when the only illuminant for a compositor was a tallow candle stuck on one of the boxes of the case. Then came gas, and this was followed in turn by electric light, but it was a long time before any serious attempt was made to shade the lamps and place them in the correct positions. He well remembered when the electric light came into the office in which he then worked that the light was so placed that the men had to wear shades to prevent the light falling full on the eyes. He personally would prefer lamps mounted well overhead, out of the direct range of vision.

He supposed a stage would be reached where composing rooms and machine rooms would be adapted for lighting purposes, and not the light adapted to the rooms—in other words, where the buildings would be of such a character that it would be an easy matter to so adjust the light to give the greatest benefit to those who were to work by it, and, might he add, the greatest advantage to the employer so far as production was concerned. He felt sure that, as far as the printing trade was concerned, Mr. Gaster would find a ready and open field both with workmen and employers

for his efforts to obtain better illumination. The subject would be one of interest to the Joint Industrial Council of the Printing Trade, for that Council had appointed a committee to consider health matters, and as a Vice-President of the Council he welcomed the co-operation of the Illuminating Engineering Society.

Mr. A. E. GOODWIN (Secretary of the Joint Industrial Council of Printing and Allied Trades) said he could echo the words of Mr. Bowerman as to the general interest felt in all problems that affected the health and well-being of the workers in the printing industry. It must be admitted that there was still defective lighting in many printing offices, but this was not due to any lack of desire on the part of the employers to see proper lighting conditions installed; it was more due to the difficulty of getting the best possible advice on this particular problem. The illustrations that had been shown indicated the different directions in which the employers were groping towards the light, and he hoped that the result of this lecture would be to set other people investigating as to the best method of solving this problem. Better lighting was in the interests of efficiency and humanity. Of course, the printing industry had its special problems; there was a great variety in the size of printing works; some were very small and some large. In the latter, experiments could very well be tried, and the Council would be only too glad to have the co-operation of the Illuminating Engineering Society in making investigations of this nature.

Mrs. BRIDGE, speaking on behalf of the Health Committee of the Joint Industrial Council, said that the lighting of printing works had received the very careful consideration of her Committee, mainly because of the suggestions and requests for assistance on the part of representatives of the Home Office. She believed many employers at the present time were making experiments. One difficulty experienced up to the present time was that some of the technical terms used in illumination were not yet very familiar to those engaged in the industry. Many people, for instance, could not understand what was meant by defining illumination in foot-candles. Further educational work was needed, and she felt sure that the aid of the Illuminating Engineering Society would be of great value to the Health Committee with which she was associated.

Mr. A. E. HOLMES (Joint Secretary of the Joint Industrial Council of the Printing and Allied Trades) said he thought that it would be found that in some cases the men preferred to have the light just above them, and in other cases they preferred to have the light mounted overhead near the roof. Personally, he shared the view that to have local lights shaded by opaque reflectors, and look up to the ceiling and find everything dark, had a very depressing effect on the workmen. But there were other people who had a different view. At the time when he was still following his trade all compositors worked with the lights just above their heads. He rather liked the idea of having moderate overhead general illumination supplemented by local shaded lights near at hand. Experiment was the only thing that would bring out the best methods of lighting. The readiness with which employers in the printing trade took up questions of this sort was most encouraging to people on the workmen's side. Whenever a proposal was made there were sure to be one or two enthusiasts willing to make experiments in their works and report the result, and the guidance of the Illuminating Engineering Society in such matters would be welcome.

Mr. E. PONTIS said he had worked for a number of years as an electrician in the printing industry. The general complaint, he found, was that there was not enough light; he personally thought that in some cases there was too much. The complaint made was not that the light was in the wrong position, but that there was not enough. A man working with a tallow candle properly placed, so that he could see his work, was in a better position than if he had a very strong light badly arranged so as to defeat his eyesight. The problem was

the application of the light, not the amount of it.

Mr. GEORGE ISAACS (Secretary of the National Society of Operative Printers and Assistants) said that there was a great deal of work yet to be done in exploring the real difference between diffused light and direct light. He had worked in the machine room of a certain newspaper when the printing office was being rebuilt, all care and attention being then given to the light in the machine room. Among other things mercury vapour lamps were tried. He recalled that the men did not like these lamps in that office, but he had since been in several newspaper offices where mercury filled lamps had been in use for years, and where the men were quite satisfied with them. It was, perhaps, a fad on the part of the workmen in the machine room where he had worked that they did not like the new light, but it was necessary to have regard to these fads of the workmen.

A problem in lighting a machine room was that besides the general lighting of the room it was necessary to have lights in some of the larger machines, and it was difficult to arrange so that the light which was convenient for one man on one side of the machine, was not shining directly into the eyes of his mate on the other side of the machine. If the Illuminating Engineering Society could suggest suitable methods of applying indirect light in places like that, this would be very beneficial.

There was no doubt that many accidents and injuries to workmen could be prevented by better lighting; and the lighting should be arranged not only with a view to production, and with a view to ensuring the safety and comfort of the men. In his experience he had found that if one called the attention of an employer in the printing trade to any way in which he could make his works safer or better he would do it; but there was need for guidance in regard to lighting matters, and the help of the Society in this field would be much appreciated.

Mr. J. R. RIDDELL (Principal of the London School of Printing) said that the remarks of the members of the Joint Industrial Council for the Printing and Allied Trades showed that there was a feeling that much remained to be learned regarding the lighting of printing works. He would like also to hear more from the illuminating engineers on this subject. He himself could claim to have had actual experience in arranging the lighting of a printing office, and he agreed that the positions of the lights was of the greatest importance in getting full value from the illuminant.

After trials of most systems of lighting he was a confirmed believer in the semi-indirect method of lighting with high candlepower freely but economically dispersed throughout the room. Experience had brought home to him that the nearer the illumination of a printing office could approximate to nature, one was well on the way to getting the best results. Lighting engineers were apt to be guided by pet theories on the subject, which they proceeded to put into operation without consultation with those who had to work under the conditions which they determined. Further, he would suggest that when a firm was erecting a building for a special purpose, the architect should consult those who had to deal with the lighting of the building. Frequently it was difficult to get the highest efficiency from artificial lighting owing to some constructional feature.

In seeming contradiction with what he had just said, he would like to pay a tribute to the helpful manner in which the officials of a public department co-operated with those responsible for the new London School of Printing, which is partially maintained by the Printing Trades of London, with the result that at Stamford Street there is a system of lighting which was second to none in any printing office in the country. He wished to extend an invitation to any present to come and see for themselves the efficient system which had called forth the highest praise not only from lighting engineers but also from employing and working printers.

He would have liked to have heard something about suitable lighting for the protection of the eyes from the

glare of light reflected from new type—a cause of much eyestrain and sometimes accidents. He noticed that reference had been made to a frame covered with translucent paper as a screen for lights used in lithography and etching. This method of obscuring light was generally discarded many years ago and ground glass used in its stead.

It was with great pleasure that he noted Mr. Gaster's plea for co-operation between the illuminating engineer and the printer. He believed that standardisation of lighting in the various departments of a printing office could only be achieved on these lines. Such standardisation would not only benefit the worker but would be economical in cost; for, next to wasted labour, there is no readier means of reducing profits in a printing establishment than bad lighting, whether it be by dirty windows or inefficient artificial lighting.

In conclusion, Mr. Riddell said that he would like to add to his appreciation of Mr. Gaster's paper one suggestion, namely, that before it was published he should change the words "compositors' benches" to "composing frames." This might seem a small point, but to printers, who are a hypercritical class, correct terms made a special appeal.* He thanked Mr. Gaster for what he had said and hoped that at no distant date there would be a combined committee composed of those who were actually working under the conditions which prevailed in printing offices at the present day and the practical illuminating engineer.

MR. GEORGE W. MASCARD said he had been struggling with the lighting of printing offices for twenty years. Listening to the lecturer, he was reminded of an argument that he had put forward many times that good lighting and plenty of it never injured anybody. He had recently used that argument with the operator of a linotype machine who was complaining of the intense light—really the man was complaining indirectly of his own eyes. Mr. Isaacs had referred to the introduction of the Cooper-Hewitt lamps. He (the speaker) remembered putting up the first eight Cooper-Hewitt lamps, the ones referred to by Mr. Isaacs, in his printing works twenty years ago. At that time they proved ineffective, and subsequently inverted arcs were used and provided the finest source of light that ever was there. These might have continued in use but for the war, but owing to the difficulty of procuring carbons they were removed and Cooper-Hewitt lamps again installed. These were now a great success, providing thoroughly well diffused light. In their composing rooms they had various forms of gasfilled lamps (inaccurately termed "half-watt" lamps).

Lighting the composing room presented one of the most difficult problems of any business. He had tried diffused lighting, and immediately had a deputation to say that this was not suitable for the men setting small type used in advertisements—that for this the light must be on the job. Accordingly, lights were put in to let the men have the light on the job, and now those lamps were decorated with fancy screens. If the Industrial Council could find a method of lighting that would commend itself to the eyes of all the workers this would be a wonderful thing. He had no doubt that what was needed was to get as near to daylight as possible inside the works. He considered the old editorial room at the printing works where he was engaged and also the compositors' room as well lighted as any room of its kind in the world. He had been told this by the manager of one of the finest equipped printing offices in the world, namely, the Curtis Publishing Company in Philadelphia. The lighting was not so good to-day as when the remark was made; this was on account of their having had to dispense with the arc lamps.

A remark had been made in the discussion about having too much light; he thought that the light might be too intense in one place—for instance, the exposure of gasfilled lamps was objectionable unless they were frosted or obscured in such a way that their direct rays did not fall on to people's eyes. Many people still preferred local lights, and if you tried general lighting, in the course of a few days you would get an

*This correction has now been made in the text of the paper.—ED.

application for lights to be fitted here and there. He would like to supplement what had been said about the help printers and illuminating engineers might be to each other. In his own particular concern the printers would be pleased to do anything they could, or to afford any information as to what they had done, and to let the illuminating engineers take photographs, test colours, and so on.

Mr. J. G. CLARK said that as far as he knew this was the best co-operative meeting of the Society that he had ever attended, where those who provided the light and those who used it met together to listen to each other's point of view. He had learned a lot of interesting things from the friends in the printing trade. Mr. Goodwin had alluded to the difficulty of getting advice; if the printing trade could be convinced that a lot of good advice was available if asked for, a great step would thereby be made in improving the printing trade lighting. Mr. Gaster had referred to the small cost of lighting in relation to the total cost of running a printing business. That was a very important point indeed, and it ought to be coupled with the fact that working costs were often reduced by better lighting. A point to be remembered was that when lighting was improved by the use of proper reflecting shades, there was often a considerable saving in the amount of energy used to produce the light. One not only got improved lighting from the point of view of the absence of glare, but also a higher illumination for the same consumption of gas or electricity. A point often forgotten in printing works was that in providing a lamp for a given workman, that lamp must be considered not only in relation to the workman for whom the light was provided, but also in relation to the other workmen in the office. Mr. Isaacs had alluded to this point. Subdivision of units might sometimes prevent a lot of waste; you might have varying numbers of men at work in a particular place, and rather than keep the whole installation going, you might subdivide it in such a way that you need not provide more light than was needed for the men actually employed. Brightness of walls was very important, especially in daylight. With well shaded lamps the brightness of the walls did not matter very much, but after all most work was done during the hours of daylight.

Mr. G. CAMPBELL said this meeting had afforded an exceptionally good opportunity of hearing the views of those mainly interested, of the men in the trade for whom the lighting was provided, and the outcome of those remarks, he thought, would be most valuable in giving illuminating engineers an indication as to how to solve their problems. He wondered if those in the industry realised how difficult it was to meet their demands; one man might say a system of lighting was splendid, and another might say it was wrong. This fact emphasised the need of some central committee of recognised authority which would lay down some standard of lighting. The speaker who had advocated less light had apparently in mind less glare and contrast. It could not be said that demands as regards actual illumination on the work had been exceeded. Diffused daylight was what was wanted, and one could feel sure that within the next ten years artificial lighting would reach higher standards of intensity with absence of glare and contrast. In one printing works in London there had been a saving of twenty per cent. in money, with forty per cent. more light, because of the application of sound principles of illuminating engineering. (Applause.)

Mr. P. J. WALDRAM said that the paper and discussion had been concerned mainly with artificial lighting; but although a good deal of printing was done by night still more was done in the daytime, and was then carried on very often under daylight conditions which were absolutely atrocious, and could easily be improved at a trivial cost. The whitewashing of walls opposite windows, and the cleaning of those windows, made an enormous difference. Glass, without seeming to be very dirty, might be absorbing ten, fifteen, or twenty per cent. of the light that should come into a room. In such a case a few

pails of warm water with soap would greatly improve the light.

He thought it had not been sufficiently recognised in the discussion that daylight and artificial light were not the same thing. One could not receive the same amount of light artificially in foot-candles as in the case of daylight, and the more work one could carry on in daylight the better. It was obvious that the more nearly artificial light approached daylight conditions, the better it would be. There were now available some excellent forms of artificial daylight units. It was said that such lamps were expensive because sometimes sixty or seventy per cent. of the light was lost in the process of correction. But this loss in absorption was not a very serious item in comparison with the advantage of securing correct appearance of colours by artificial light.

Mr. F. E. LAMPLOUGH, M.A., King's Norton, exhibited to the meeting a 100-watt daylight lamp of the type which he had recently introduced. He said that they would notice that the lamp gave a light of pure whiteness which was a closer imitation of daylight than had hitherto been obtained. This result was achieved by a double glass screen of novel composition, and, by the use of an efficient reflector, a good concentration of light was given by the lamp. He mentioned that a lamp of this kind was useful, not only where it was required for colour matching, but also to give relief to eyesight tired by long or trying work in the unnatural yellowness of artificial light. He would be very pleased to do anything to facilitate tests of the lamp, from either point of view, which any printer might like to carry out in his works.

Mr. P. WALMSLEY (*communicated*): Mr. Gaster in his lecture raised the question whether individual shaded lights or overhead illumination was better for the compositor. The work of a compositor makes exacting demands on the eyesight, and speaking as one who worked at case during the period of the naked fish-tail gas burner, followed later by the unshaded incandescent gas burner, and later still by the single electric light bulb, there is no question in my mind that our present system of lighting is far superior to any of the foregoing. We use the gasfilled lamp placed high overhead, protected with an opaque or frosted bowl and reflector. The result is a good general illumination of the whole room, as well as a sufficiently good light for local purposes. Such a system seems to me to be much more comfortable than individual lights, and, speaking as one who is rather sensitive to light, involves much less eyestrain. It needs to be remembered that the modern compositor is not quite so confined to one position as was the old-time compositor, since his work requires a certain amount of movement, consisting, as it does, either in handling machine-set matter, or in setting up display matter. Passing from one position to another, a compositor in our works finds uniform lighting, whereas with local lighting only there would of necessity be a variation in the amount of illumination at one point as compared with another.

When it comes to machine composition, however, local lighting proves preferable to general illumination, since here the operator is confined to one spot and needs a concentrated light both on his copy and on his keyboard. In our works these lights are enclosed within a deep shade so that no rays from the lamp come in contact with the operator's eye. Coming to the machine room, a number of years ago we used individual local lighting, but we now use the overhead general illumination, which in my judgment is far better, since even lighting is obtained. I always found it very distracting when working either at case or machine having to work at one moment under a good illumination and at the next moment under an inadequate illumination. That is why I do not favour individual local lights except for special operations.

Mr. JUSTUS ECK (*communicated*): It has been a great pleasure to me to be able to attend this meeting and listen to Mr. Gaster's interesting paper, and especially to note the large number of speakers, and others, in the audience who are practical printers.

Lighting is always of great importance

to printers, but in addition theirs is one of the few trades that is to a very large extent carried on, compulsorily, with artificial light. Morning newspapers must, for daily circulation, be printed at night, and the requirement for rapid distribution makes underground machine rooms a necessity.

Emphasis has been laid on the small relative cost of lighting, but it should be made clear that good lighting usually costs less directly, as well as indirectly, than bad lighting.

The volume of light given cannot be too great, but care must be exercised to avoid too great contrasts, that is to say, there must be careful gradation. Light sources, especially electric ones, are made in a great variety of candlepower, and correct grading is easily obtained, but it must also be maintained, and I should welcome a campaign of information among those members of the printing trade who are concerned with maintenance so that good installations were not permitted to degrade.

The dust and depreciation bugbear must also be persistently combated. Fittings which prevent the accumulation or deposit of dust must be used, reflectors must be cleaned, wall surfaces must remain in the same state for reflection, lamps must be weeded out before they become "glow-worms."

Those who desire good lighting, and it is nowadays a disgrace not to have it, should not merely ask a gas or electric engineer to do the work, they should see that he is also a competent illuminating engineer. Anybody can put a bright light in, but only the illuminating engineer, with experience and impartiality, can give the best results.

As regards colour of light, I maintain that the arc lamp is the best to work with and that it gives the most uniform colouration of approximately daylight effect independent of the pressure variations that occur in everyday practice.

The so-called half-watt lamp, which now calls itself "gasfilled," is for ordinary sizes not in any way superior to the tungsten filament "vacuum" lamp of 12 years ago, as regards light for energy consumed, so that costs remain as when I read my paper in 1911 except that the imposition of an import duty on carbons has advanced their price 33 per cent., but that is a transient matter that will soon be righted and is not a serious hamper in practice.

Mr. L. GASTER, in reply to the discussion, expressed his appreciation at the presence of so many representatives of the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom, and also of the kindness of Mr. Bridges in presiding at somewhat short notice. He agreed with Mr. Clark that this meeting had illustrated particularly well the practice of the Society in inviting the co-operation of users of light as well as lighting experts, and he felt that there were many problems in industrial lighting that could only be satisfactorily solved on this basis. He has been pleased to note Mr. Bowerman's statement that both employers and workers would welcome the co-operation of the Society in obtaining better lighting and Mr. Goodwin's remark that such bad examples as existed were not due to lack of desire to have good conditions, but only to imperfect knowledge of lighting requirements. Mr. Holmes and Mr. Isaacs had expressed similar views, and the invitation extended by Mrs. Bridge to the Society to participate in the experiments of the Health Committee of the Joint Industrial Council on lighting was also much appreciated. The sympathetic attitude of this Council was, he believed, typical of joint industrial councils who had been approached by the Home Office in regard to Industrial Lighting, and their help would be invaluable.

Members of the Society would be grateful to Mr. Riddell for his invitation to inspect the lighting arrangements at the London School of Printing. With regard to the method of lighting tables devoted to etching and lithography, he would like to explain that the illustration shown in the lecture was obtained prior to the war, and was intended to show the *method* of diffusion of light, rather than perfection in detail.

He noted in the remarks of Mr. Riddell, Mr. Mascard and Mr. Walmsley agreement that in modern compositors' rooms general diffused lighting was preferable to the old system of providing lights

for individual frames, leaving the rest of the room in subdued light. There was no doubt that the former method was becoming more general, but this was just one of those points on which it was useful to have the views of those actually engaged in the industry. Mr. Campbell had pointed out the difference in view existing on some of these points and the need for a definite ruling. In reply to Mr. Waldram, he would like to say that he fully appreciated the importance of good daylight illumination. But it was impracticable to deal with both natural and artificial lighting in a paper of moderate length, and Mr. Waldram himself had recently provided the Society with a very able summary of recent work on daylight.

Mr. Gaster said that the Society proposed, at the first opportunity, to form a joint committee to deal in detail with the lighting of printing works, as had already been done in connection with such problems as the lighting of schools and libraries. The co-operation of the Joint Industrial Council of the Printing and Allied Trades would be most welcome, and in this way much useful information should be obtained. As an illustration of the steady growth of interest in the well-being and safety of workers in various countries, he recalled that when, in 1912, he and Mr. Bowerman attended the first International Congress for the Prevention of Industrial Accidents, in Milan, they inspected a printing works that was a model installation. The arrangements for lighting, heating and ventilation were exceptionally complete and all the latest safety devices were in use. These good conditions were due largely to the Italian association of manufacturers for the prevention of accidents.

Recent improvements in industrial lighting in this country were greatly influenced by the judicious action of the Home Office and the very comprehensive work of its Departmental Committee on Lighting in Factories and Workshops. The discussion had shown the need for further investigation before fixing definite standards for the working illumination for industrial processes, and it was generally recognised that the Home Office had acted wisely in inviting the co-operation of the joint industrial councils in order to settle the essential principles involved in industrial lighting.

NATIONAL PHYSICAL LABORATORY—ANNUAL VISIT.

The usual annual visit to the National Physical Laboratory took place on June 26th. In the photometric laboratories methods of determining mean spherical candlepower and distribution of light were shown. Experiments are also being conducted with photo-electric cells. Other interesting features included the spectro-photometric testing of light-sources and "artificial daylight," and an exhibit of the constant temperature black body standard of light, which is, however, still in the experimental stage. Special interest was shown in the new building for researches on daylight illumination, which has previously been described in this journal. In the optics division there were also several useful exhibits, including the Nutting colorimeter and methods of testing the loss of light in instruments.

FORTHCOMING CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY (U.S.A.).

The 1923 Convention of the Illuminating Engineering Society in the United States is to be held during September 24th—28th at Lake George, N.Y., one of the most picturesque resorts in America. The inaugural address will be delivered by the President, Mr. Ward Harrison, and it is stated that an interesting series of commercial and technical papers has been arranged. There will also be special illustrations of spectacular lighting.

Dr. Louis Bell

Born December 5th, 1864.
Died June 14th, 1923.

IT is with great regret that we record the death of Dr. Louis Bell, who passed away on June 14th. Dr. Bell was one of the most brilliant and versatile engineers in the United States. He was associated with many American scientific and engineering bodies and carried on a consulting engineering practice in Boston for nearly thirty years. He took out many patents referring to optical apparatus, and he also took a special interest in spectroscopy and physiological optics. He was for a time Professor of Physics at Layfayette University and for many years Editor of the *Electrical World*. He also served on many Committees and was for six years Chairman of the Incandescent Lamp Committee of the National Electric Light Association.

But it is in connection with illuminating engineering that his name will be best known to our readers. His book on *The Art of Illumination*, which appeared in 1902, was the first treatise on illuminating engineering published in the United States. When, a few years later, the American Illuminating Engineering Society was formed, Dr. Bell became one of its strongest supporters and subsequently occupied the Presidential Chair. From the very first he also took a great interest in the work of the Illuminating Engineering Society in this country. A few months after this Journal was issued he contributed a message of encouragement and sympathy to our readers. He also shared in the very first discussion initiated by the Society, on the subject of "Glare: Its Causes and Effects." He was always quick to respond to any request for information, frequently sending contributions to discussions on street lighting, photometry and similar subjects. In recognition of his services to illuminating engineering he was created a Vice-President of our Illuminating Engineering Society.

The writer had the pleasure of knowing Dr. Bell and appreciating his genial and interesting personality. He received much kindness from him when he visited the United States in 1907, prior to the initiation of the illuminating engineering movement in this country, and again in 1912. Meantime, in 1908, Dr. Bell had made a visit to Europe for the purpose of studying developments in street lighting, and had become known and appreciated by many of those associated with lighting in this country. Dr. Bell was an excellent conversationalist. Not infrequently, his explanation of some point would be illuminated by some flash of humour or some quaint comparison. His wide and profound knowledge, and his gift for lucid exposition, doubtless acquired through his experience as an editor and lecturer, reminded one of the late Professor Silvanus P. Thompson. He had the same broad outlook and the consideration for others, the same willingness to respond to any request for help or information.

By his death illuminating engineering has lost one of its most eminent exponents and the news will be received with great regret by the many friends which Dr. Bell had formed in this country.

PROGRESS IN ILLUMINATION.

A REVIEW of progress in lighting, given of a recent address by Dr. Teichmüller before the "Lichttechnische Geseilschaft" in Karlsruhe,* is interesting as showing how the same problems are exciting attention in different countries. In opening his address the author remarked that the inauguration in June last year of the first Illuminating Engineering Institute (Lichttechnische Institut) at a German technical college was an important advance. Some might consider that the time was not ripe for this step, but there were many special problems requiring attention at its hands.

One of the most important of these was the question of glare. This was usually considered entirely in relation to possible injury to vision ; but its effect in diminishing acuteness of vision was in many cases even more important. Recent investigations had enabled a clear idea to be formed of the very low efficiency of most illuminants, and indicated the scope for future progress. The best hope of future improvement lay in the direction of utilising luminescence instead of incandescence. In this connection the introduction of the small candlepower neon lamps was of great interest. In spite of the small light yielded such lamps had many useful applications, *e.g.*, as night lights in hospitals, for passages and stairs, in kinema theatres, etc. Gas lighting had suffered from the poor quality of gas arising from the chronic lack of coal. But those who foresaw the disappearance of gas as an illuminant should remember the revolution brought about by the discovery of the incandescent mantle ; in this respect history might repeat itself.

One of the chief tendencies in modern methods was the substitution of a few large and efficient units for a number of small ones. An instance was afforded by the waiting room of the main railway station at Frankfort, formerly lighted by chandeliers equipped with very numerous small lamps, for which four gasfilled lamps in modern fittings had been substituted. It was gratifying to observe the influence of illuminating engineering on the design of fittings, exemplified by the great variety in distribution of light that could now be obtained from different forms of reflectors. Important investigations on reflectors, which might lead to some degree of standardisation, were in progress. There was room for revision of ideas of efficiency and terminology, in order to avoid confusion and describe the qualities of lighting units correctly. A new term instead of the vague description "fitting" was needed. In America it was proposed to adopt the term "luminaire." In Germany opinion seemed to favour the expression "Leuchte."

Similar progress was being made in the rating of lamps, and the old method in terms of candlepower was giving place to flux of light. Makers, however, were averse to marking this flux of light on the lamp-bulbs and preferred to indicate only the consumption ; his objection to this was that a consumer might obtain too little light for the specified watts.

Attention was also being devoted to colour. Within recent years a firm in Munich had developed lamps with a suitable filter intended to provide light resembling normal daylight in colour-revealing qualities. Work now in progress indicated the possibility of a simple apparatus for studying the colour of such lighting units. At present, as tests in the Institute had shown, such an apparatus was lacking and variations in colour must be studied with the spectrophotometer. Closely allied to this question there was the problem of evolving standards for coloured light.

* Delivered April 17th, 1923. See *Licht und Lampe*.

Much still remained to be done in both private and public lighting and attention might be drawn particularly to the great defects that were common in the lighting of railways. A greater appreciation of the possibilities of natural and artificial light on the part of architects was also desirable. He might mention some researches conducted at the Institute in Munich on the transmission of light through double pane windows which would be of great utility to the architectural profession. Another useful piece of work was the process for determining access of natural light into interiors worked out by Prof. Ondracek in Vienna.

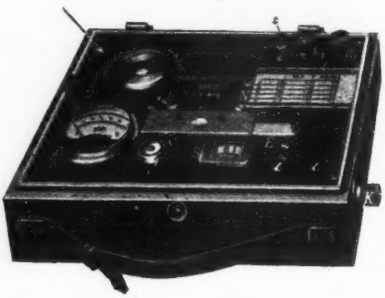
Public lighting, which had been neglected during the war, was once more receiving some attention. Economy was still necessary, but should be allied to scientific choice and use of illuminants and accessories. Unfortunately, the statistics available on accidents in the streets did not yet enable one to answer completely the question how far public lighting exercised an influence on accidents in streets. Data of this kind were much to be desired.

A gratifying sign had been the use of demonstrations, side by side, of good and bad methods of lighting by undertakings in several towns. Useful work had been done by the Illuminating Engineering Society and the Institution of Electrical Engineers (V.B.D.) in connection with definitions, standards, recommendations, etc. He thought that in future more attention should be paid to illumination of vertical surfaces as well as horizontal ones. Until recently there had been a lack of a convenient and simple form of illumination photometer, but an instrument devised by Franz Schmidt and Haensch seemed to meet requirements. Another new apparatus deserving of attention was the Norden apparatus for the measurement of shadow. What was still needed, however, was a simple apparatus for measuring *brightness*, the importance of which had been increasingly recognised during recent years.

A NEW ILLUMINATION PHOTOMETER.

The new illumination photometer mentioned by Dr. Teichmüller and mentioned above is described in a contribution to *Licht und Lampe* by W. Bechstein.

In general appearance the apparatus has a good deal in common with the



"Foot-Candle Meter" developed in the United States, to which he refers. But instead of a series of spots of graded brightness, photometric balance is effected by diminishing the light from the comparison lamp within the instrument in the usual way. Some elements in the design resemble those embodied in recent British and American instruments, but there are also new features. The comparison lamp is enclosed in a tube terminating in an opal glass plate, in front of which are a series of circular apertures which can be gradually exposed or covered by a rotating diaphragm. The corresponding scale in foot-candles is calculated and is not far removed from an evenly divided one. The method of reading is novel, the scale being engraved on the perimeter of a disc in

connection with the diaphragm, operated by a rack and pinion. The observer inspects the scale through a small window.

The light emerging from the tube illuminates a second inclined plate of diffusing glass which forms one photometric surface. The other "test" surface is a plate of barium sulphate with a very fine bevelled edge situated on the front of the instrument. The observer looks past this at the interior surface in somewhat the same manner as in the Trotter photometer, and the line of division is stated to be very fine. An optical device is included to ensure constant angle of view.

An interesting feature is the method of increasing the range of measurement. This is done in a novel manner, for the position of the test-surface, mounted on the face of the apparatus, precludes the use of dark glasses to extend the range upwards. The scale registers from 0·5 to 11 lux. This can be magnified 10 times or 50 times by substituting for the white vast screen similar screens of specially prepared grey mixture, reflecting respectively 10 per cent. and 2 per cent. of light. At present it has not been found possible to prepare a surface reflecting only 1 per cent. By using this device values of illumination up to 500 lux (roughly 50 foot-candles) can be measured. In dealing with very low illumination the scale can be extended downwards by operating the lamp at an assigned lower voltage reducing its light to 1/10. The lamp is underrun but the colour is brought into approximate resemblance to the light from an ordinary metal filament lamp by the insertion of a glass with a slight blue tint.

The photometer is provided with a switch rheostat and ammeter, and it is estimated that the accuracy in practice should attain 5-10 per cent.

The accompanying illustration gives a good idea of its general appearance.

GAS LIGHTING IN BELFAST.

In his presidential address at the Belfast meeting of the Institution of Gas Engineers, Mr. J. D. Smith made an interesting quotation from the *Belfast News Letter* of 1823, referring enthusiastically to the gas lighting installed in that year. "The light now used," it was stated, "is of the purest kind shedding on the streets a brilliant lustre—pleasing but not dazzling—and more resembling the clear effulgence of a cloudless atmosphere illuminated by the moon than any artificial beams heretofore produced by the imitative power of man. Living objects in our streets thus illuminated were distinctly seen, even at remote distances,—and did not, as formerly, resemble shapeless masses, now moving in obscurity, and now tinged in part with a doubtful gleam of light, twinkling upon them from dull or expiring lamps."

When one recalls that the lighting of this period was effected by early batswing burners, one wonders how the writer would have described the high pressure incandescent gas lighting in Belfast to-day!

Mr. Smith also mentioned that the first Act of Parliament, dated May 23rd, 1823, enacted that companies were required to supply gas "of such quality as shall at all times afford a cheaper and better light than could be obtained from oil." It would be noted that the new illuminant was to be *both* cheaper and better than oil; apparently this condition was fulfilled, as Belfast streets have been lighted with gas from that day to the present time.

In the concluding portion of his address, Mr. Smith emphasised the great value of the work being initiated by the Institution for the better education of gas engineers, and paid a tribute to the services of our "well informed Technical Press" as another useful educational medium.

TOPICAL AND INDUSTRIAL SECTION.

[At the request of many of our readers we have extended the space devoted to this Section, and are open to receive for publication particulars of interesting installations, new developments in lamps, fixtures, and all kinds of apparatus connected with illumination.

The contents of these pages, in which is included information supplied by the makers, will, it is hoped, serve as a guide to recent commercial developments, and we welcome the receipt of all *bona-fide* information relating thereto.]

A DEMONSTRATION OF ELECTRIC LIGHTING.

An interesting demonstration of methods of lighting with special reference to the needs of factories and workshops was recently given by Mr. W. E. Bush, at the B.T.H. showrooms at Savoy Place.

After an introductory address by Mr. J. N. Stephens, Mr. Bush gave a summary of recent developments in industrial lighting, emphasising the benefits of good illumination in the form of greater freedom from accidents, less spoiled work and improved output. To the members of the Illuminating Engineering Society, who formed a considerable proportion of the audience, this matter was naturally familiar, but some of the experiments by which the lecture was accompanied were novel and ingenious. In order to illustrate the appearance of the room by different methods of lighting each group of people was provided with a foot-candle meter, and values of illumination were measured and averaged as different combinations of lighting units were turned on.

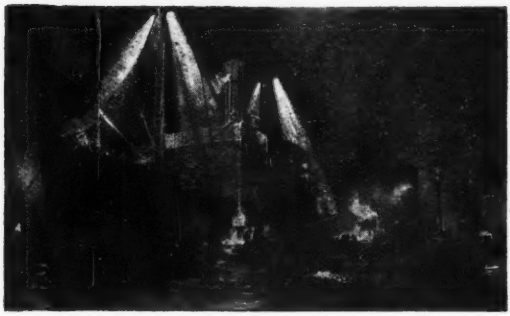
There was also a small model shop-window which could be lighted either by the approved method of concealed sources or by exposed bare lamps, and the much more pleasing effect of the former method strikingly illustrated. Effects of glare were also shown by means of an aperture in a placard, behind which was a powerful source. When this was switched on the effect of the direct glare in making the wording difficult to distinguish was manifest. In another cabinet a cylinder, on which letters were inscribed, was set in rotation. With a high illumination it was possible to read the letters, but in a dim light this could not be done, and the cylinder also appeared to be travelling much faster. Other cabinets round the room with concealed lights operated by automatic switching devices, aptly illustrated effects of changing colour and shadow.

The demonstration was given on two successive days. At the end of the proceedings Mr. L. Gaster, in proposing a vote of thanks to the Company for the display, stated that the Illuminating Engineering Society would welcome efforts by leading firms in the lighting industry to give publicity to the aims and objects of the Society, and the principles of good lighting formulated at its discussions.

G.E.C. FLOODLIGHTS FOR HOARDING LIGHTING.

The great advance in the design and execution of advertising posters during recent years has often been the subject of comment. At the same time more care is being paid to the efficient illumination of such hoardings by concealed sources. Our attention is drawn to one of the Osram advertisements at Chiswick, lighted by this method. The hoarding is approximately 28 ft. high and 40 feet long, and is lighted by only three units, each comprising a 500 watt gasfilled lamp in the "Wembley" reflector fitting. The brackets project only 3 ft. 6 in. from the hoarding, and the illumination is stated to be extremely even—a result which is ascribed to the wide spread of light from these units, enabling them to be spaced as much as 15 ft. apart. The consumption is given as 1·34 watts per sq. ft., which is regarded as very moderate in the circumstances.

THE UNLOADING OF SHIPS BY NIGHT.



THE use of artificial light is often of considerable value in emergencies when ships must be loaded or unloaded as quickly as possible, and it is desirable for work to proceed by night. The accompanying illustration is taken from a recent booklet issued by Messrs. Allen Liversedge, Ltd., and shows the use of Imperial flares mounted on the masts for this purpose. Such lights have often proved useful in enabling road repairs or building construction to proceed by night.

ELECTRIC LIGHTING IN COUNTRY HOUSES.

A BOOKLET issued by Messrs. Mann, Egerton and Co., Ltd., contains a useful review of methods of lighting country houses by electricity, special attention being directed to automatic and semi-automatic sets. Consumers are advised to use metal filament lamps, and particulars of other electrical appliances are included. At the end there is some useful information on the care of engines and battery, the replacement of fuses, etc. The booklet might be improved by a little more guidance on the use of lamps and fittings to secure efficient illumination—which affords quite as good an opportunity for the skill of the contractor as the correct installation of plant.

SIEMENS' ELECTRIC LAMPS.

THE usual monthly list issued by Messrs. Siemens and English Electric Lamp Co., Ltd., contains particulars of standard lamps and many supplementary lighting accessories including "Zed" fuse boards and a range of bowl fittings. Data referring to lists of wireless sets, electric fires and kettles, etc., are also included.

MAXLUME REFLECTORS.

WE have received from Messrs. Veritys Ltd. a copy of their recent booklet on "Maxlume" reflectors, dwelling chiefly on their merits for industrial lighting. The chief feature of the booklet is a summary on page 2 of extracts from the reports of the Departmental (Home Office) Committee on Lighting in Factories and Workshops, and elsewhere special forms of reflectors, designed to comply with the Committee's requirements on glare, are illustrated. There is also a short introduction containing data on lighting calculations and definitions of the chief photometric quantities.

The booklet contains a very varied selection of lighting fittings and the data in regard to prices and dimensions are conveniently arranged. A little more information about the polar curves of the various lighting units would, however, be welcome.

In the concluding portion of the booklet some forms of semi-indirect units are shown and we note that the firm is also listing a type of "artificial daylight" unit.

REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED.

L'Hygiène de l'Oeil et Le Travail Industriel: Les Problèmes de l'Éclairage Industriel. (*Published by the Bureau International du Travail, League of Nations, Geneva.* 1923. *pp.* 160. *Price* 3 *fr.* (*French*), 6 *fr.* (*Swiss*).)

MANY of our readers are aware that industrial lighting has been the subject of special study by the section of industrial hygiene of the International Labour Bureau of the League of Nations, with which Dr. L. Carozzi, a corresponding member of the Illuminating Engineering Society, is associated. The first fruits of this investigation are now presented in a most comprehensive Report. It is pointed out in the introduction that good industrial lighting is necessarily based on the study of the hygiene of the eye. Accordingly the matter is considered with special care from this standpoint. Although the problem is complicated somewhat by personal differences, influence of locality, climate, etc., one can deduce principles of general application. The complete information now available, such as that collected by the Home Office Departmental Committee on Lighting in Factories and Workshops, makes the problem much easier than in the past.

The initial section of the Report is given up to definitions of the chief photometric quantities, and a table of symbols presented by Prof. A. Blondel at the first technical session of the International Illumination Commission is presented. After a brief section on daylight, the report passes on to consider artificial lighting in factories, the use of globes and reflectors, and the necessary illumination. Reference is made to the American codes and a table of value indicating approved modern practice, is included.

In the next section of the Report conditions of work, and their effect on the eye, are discussed, and the important relation between the coefficient of reflection of the material and the necessary illumination is pointed out. Acuteness of vision, and circumstances leading to fatigue of the eye are treated in detail, a specially useful contribution being the data showing the extent of defective vision in various classes of workers. Recent investigations on effects of ultra-violet light are briefly summarised. In the ensuing chapter on accidents the Reports of the British Home Office Committee are again quoted to illustrate the connection between inadequate illumination and accident rate. This leads to a review of recent progress towards legislation on industrial lighting. The summary of conclusions emphasises the importance of good illumination, the value of photometric measurements, and the utility of recent official investigations which may ultimately lead to an "international code" of industrial lighting. There is a useful bibliography, and various specialised matters are dealt with more fully in an appendix in small type.

The Report contains an excellent summary of recent work on industrial lighting in Europe and America and is aided by a number of illustrations, many of which are reproduced from the booklet recently published by the British Industrial Safety First Association.

This Report furnishes an encouraging illustration of the fact that industrial lighting has become a subject of international interest.

Light and Colour. By R. A. Houstoun (*Longmans, Green & Co.* 1923. 7*s.* 6*d. net. pp.* 179. *Figs.* 71.)

PROFESSOR Houstoun, in his preface, states that this book is intended primarily for amateurs. Much of the matter, though also of interest to the student, is very readable. The treatment in the early chapters of the nature of light and the spectrum, etc., is on familiar lines, but Chapter III. on "Invisible Rays," and Chapter IV. on "Atoms and Stars" break somewhat new ground and the discussion of the structure of the atom and mass spectrographs, etc., is interesting. Colour blindness and colour photography are dealt with in a popular manner. In "The Light of the Future," Professor Houstoun deals with a matter of interest to the illuminating engineer. The final chapters are devoted to photo-chemical effects, phototherapy and the psychology of colour. While some of the conclusions in this field must be regarded as tentative they serve to show what a wide field exists for further experiment on these curious effects of light on the mind and body.

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CORRESPONDENCE.

THE EFFECT OF LIGHT ON EYESIGHT.

MY DEAR GASTER,

I notice in the copy of the ILLUMINATING ENGINEER, edited by you, No. 2, Vol. XVI., February, 1923, the page devoted to "The Effect of Light on Eyesight." I absolutely agree with your position in this matter. I am satisfied that the forms of artificial illumination used are no more injurious than the sun's rays, and, of course, there is no approach to the intensity of open sunlight in any proper forms of illumination.

If personal testimony is worth anything, may I say that although I have exposed my own eyes, for a period of at least fifty years, to strong lights of various types, from powerful arcs down, I find that my sight is certainly not worse than would be expected to be possessed by one of my age. In fact, it is probable that my sight and the control of my eyes is better than the average. I have read in dim lights and I have read in strong lights. I have read extensively, and I am convinced, from my own experience, that a great deal too much is made of eyestrain, as connected with forms of artificial illumination. I had rather look into the nervous condition of the individual, as to general health, tone, habits, etc., for any failure of the faculties in this regard.

Very truly yours,

ELIHU THOMSON,
General Electric Company,
West Lynn, Mass., U.S.A.

Colour and Methods of Colour Reproduction. By L. C. Martin, with chapters on Colour Printing and Photography by W. Gamble. (Blackie. & Son, Ltd. 1923. 12s. 6d. net. pp. 187. Figs. 93.)

THE book is divided into three portions. Part I. gives a simple account of colour measurement and colour nomenclature. Part II. is intended to provide an introduction to the more advanced study of colour measurement and colour vision. Part III. by Mr. Wm. Gamble, deals with colour printing and photography. Chapter I. deals with such elementary matters as the actions of prisms and lenses, the nature of the eye, definitions of hue and wave length, etc. We then pass on to the spectroscope, the additive mixing of coloured lights, the colours of natural objects and Macwell's colour triangle. Chapter IV., dealing with "Colour in regard to illumination," will be of special interest to our readers. The relation between temperature of incandescence and the spectra of illuminants is discussed and diagrams comparing the chief sources are presented. This leads to the treatment of "artificial daylight," of which Dr. Martin has made a special study. Other chapters deal with pigments and colouring materials.

Part II. contains a discussion of colour-photometry and instruments for colour measurement and here the reader will find some information ordinarily available in textbooks. The chapters on colour-vision and colour blindness touch on the physiological side and cover somewhat debatable ground.

Part III., from the pen of Mr. Wm. Gamble, gives a readable and interesting account of modern colour photography and process work. Various tabular matter is assembled in the appendix, and there is an adequate index. The illustration throughout the book, some of them in colour, aid considerably the explanations in the text.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

Fuel Research Board.

WE understand that Sir George Beilby, after nearly seven years' service as Chairman of the Fuel Research Board and Director of Fuel Research, has resigned these positions. Mr. C. H. Lander has been appointed Director of Fuel and Sir Richard Threlfall, chairman, to fill the vacancies thus created, but Sir George Beilby retains his membership of the Advisory Council, and has consented to act as honorary adviser. Amongst others who have accepted appointment as additional members of the Board we note the name of Dr. Charles Carpenter.

We observe that the Fuel Research Board have appointed a Committee to deal with the physical and chemical survey of the coal seams in the South Yorkshire area. The chairman (*pro tem.*) is Mr. C. H. Lander, who represents the Board.

ROYAL SANITARY INSTITUTE.

Forthcoming "Health Week."

OUR attention has been drawn by the Royal Sanitary Institute to the "Health Week," which is being held during October 7th—13th. The exact procedure will naturally be modified to suit local circumstances, but should include lectures and addresses on such matters as hygiene in daily life, food in health and disease, physical culture, etc. We notice that exhibitions by gas and electrical departments are included in the list of items. Certainly in a health week good lighting, surely one of the most important essentials to health, should not be overlooked.

Particulars can be obtained from Mr. E. White Wallis, Secretary, 90, Buckingham Palace Road, London, S.W.1.

ATMOSPHERIC POLLUTION.

THE eighth report of the Advisory Committee on Atmospheric Pollution issued by the Meteorological Office (Air Ministry) contains an interesting review of research work during the year ended March 31st, 1922. The ingenious automatic filter has continued to work well and many curves showing the direct relation between the time of day and the amount of dust in the atmosphere are presented. All curves show similar characteristics; impurity is a minimum between midnight and 5 a.m. and reaches a well-defined maximum at some time during the day. The Technical Sub-Committee, on which Prof. J. T. McGregor Morris represents the Illuminating Engineering Society, is studying the question of visibility. Photometric methods of measuring the absorption due to dust have been devised and experiments will be commenced as soon as a suitable laboratory is available.

Copies of the Report (3s. net) can be obtained from the H.M. Stationery Office (Imperial House, Kingsway, London, W.C.2).